



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: DC's Contaminated Anacostia Estuary Sediments: A Biomonitoring Approach

Focus Categories: SED, TS, WQL

Keywords: sediment, toxics, urban, pollution, biomonitoring, molluscs

Duration: May 15, 1999 to May 14, 2000

FY 1999 Federal Funds: \$23,750.

FY 1999 Non-Federal Funds: \$18,170.

Principal Investigator: Harriette L. Phelps Professor, Dept of Biological and Environmental Sciences University of the District of Columbia 4200 Connecticut Ave. NW Washington, DC 20008 202-274-5888 hphelps@hers.com

Congressional District: District of Columbia

Problem and research objectives

DC's freshwater Anacostia River estuary is one of three Regions of Concern in the Chesapeake Bay Program. The lower Anacostia River estuary satisfies the three requirements to identify a toxic site because (1) there are many known toxic pollutants in the sediment, (2) the sediments have been tested as toxic to clam larvae and amphipods, and (3) the biological life is very poor. There have been many studies measuring concentrations of pollutants in Anacostia sediments. However there have been few comparable studies on the biological effects of Anacostia sediments. Toxicity has been found at certain times of the year but water in the lower Anacostia has also been found toxic in late summer. It is not known which pollutants in sediments are causing toxicity or problems in benthic organisms such as reproductive and growth impairment. It is not known which pollutants are most bioavailable to animals living in the sediment such as clams. It is not known which part of the Anacostia has the most bioavailable and bioeffective pollutants. Recovery of the Anacostia estuary will require this information for management and control of the significant pollutants.

Statement of results, benefits and/or information

The results of this research will identify the most biologically important sediment pollutants in the Anacostia river estuary out of the suite of pollutants in the estuary. It will identify which ones are bioaccumulated and their relationship to reproductive impairment, growth and toxicity effects. By testing sediments from three sections of the estuary the approximate locations of these pollutants can be found. This information will help in making decisions for bioeffective pollution control for the recovery of Anacostia

aquatic benthic life. A healthy benthic life will improve fishing and citizen enjoyment of the river, and aid in removing DC's Anacostia River from the list of Regions of Concern in the Chesapeake Bay: a very desirable result.

Nature, scope and objectives of the research

This study will use biological monitoring with a local clam species to determine which Anacostia sediment pollutants are most absorbed by adult clam tissues. It will separate the biological effects of the sediment pollutants from any effects due to toxic contaminants in the water by conducting the experiments at a control site in the Potomac. It will examine clam biotoxicity and growth and reproduction effects and relate these effects to pollutant concentrations in the clam tissues and the sediments to which they are exposed. The study will test sediments from three sections of the Anacostia estuary. This should localize the areas and types of the most biologically important sediment pollutants.

Methods, procedures and facilities

For this study, in summer 1999 we would place caged trays at a Potomac River control site, Fort Foote, with Anacostia River estuary sediments collected from a lower basin toxic site (Navy Yard), a mid-estuary site near a power plant (near New York Bridge) and an up-river nontoxic site (Bladensburg Marina). The trays would have 40 measured Asiatic clams collected from the Potomac River added to each. The control would have Potomac River sediment. This experimental design compares only the effects of Anacostia sediment pollutants as the Potomac site does not show toxic water-borne events such as found in late summer in the Anacostia.

After three months exposure including the October brooding season we will collect the clams and measure and weigh tissues for survival and growth. We will fix ten clams and count the numbers of brooded larvae, which can range up to several thousand per clam. We will freeze clam tissues for EPA Priority Pollutant chemical analysis, including PAH's, DDT, chlordane, lead and zinc. These analyses are expensive, and done best and most cost-effectively by contract with established laboratories using EPA-approved procedures. Sediment samples taken from the trays before and after the period of exposure will also be analyzed for concentrations of pollutants.

Comparing the concentrations of pollutants in the caged Anacostia sediments and clam tissues will indicate which pollutants are most bioavailable. A bioassay of this type has the advantage of integrating total clam exposure to pollutants over more than the time to take a sediment sample. Clams are particularly good for this form of biomonitoring because they lack the cytochrome P450 enzyme system for detoxifying and eliminating pollutants. From the clam mortality, growth and reproduction results we hope to identify the areas of the Anacostia where sediment are the most toxic.

There are a limited number of sources of pollutants in the DC Anacostia and this biomonitoring approach should help locate and identify those relating to its poor benthic

ecology. Potential sources include in addition to the Navy Yard, combined sewage overflows, three marinas, a power plant, and possible upstream sources. This research will localize the major types and effects of pollutants accumulated by clams which should enable planning to control sources of these pollutants for recovery of the benthic community. An Anacostia River estuary that is no longer considered toxic or a Region of Concern will be of pride and joy to the citizens of DC.